

Rhode Island Space Grant Consortium
Lead Institution: Brown University
Director: Peter H. Schultz
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Consortium URL: <http://www.brown.edu/initiatives/ri-space-grant/welcome>
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PROGRAM DESCRIPTION

The National Space Grant College and Fellowship Program consists of 52 state-based, university-led Space Grant Consortia in each of the 50 states plus the District of Columbia and the Commonwealth of Puerto Rico. Annually, each consortium receives funds to develop and implement student fellowships and scholarships programs; interdisciplinary space-related research infrastructure, education, and public service programs; and cooperative initiatives with industry, research laboratories, and state, local, and other governments. Space Grant operates at the intersection of NASA's interest as implemented by alignment with the Mission Directorates and the state's interests. Although it is primarily a higher education program, Space Grant programs encompass the entire length of the education pipeline, including elementary/secondary and informal education. The Rhode Island Space Grant Consortium is a Program Consortium funded at the base level of \$430,000 for fiscal year 2013.

PROGRAM GOALS

Consortium Goals and SMART Objectives from your 2010 base proposal and budget (or as amended in subsequent submissions)

The goals and objectives for Rhode Island Space Grant Consortium (RISG) are summarized below. These summaries are abridged for brevity, but *full descriptions of our goals can be found in our 2010 Budget Package*.

Outcome 1: *Fellowship/Scholarship, Higher Education, and Research Infrastructure programs*

1. Faculty and Research Support: Our goal was to provide NASA competency-building education and research opportunities for faculty, researchers, and post-doctoral fellows. For the Lead Institution, we proposed to allocate (from NASA) a total of \$2.1K for research support. For our Affiliates, we allocated more research support in FY'13, in order to engage more faculty and students. We anticipated making 5 awards this year. The Research Review Committee will review proposals on the following criteria (in order): relevance to NASA, merit, potential for broadening Affiliate involvement (new

institutions or faculty), and potential for new NASA collaborations. Included in these proposals are travel grants to conferences, NASA Centers, and Visiting Researchers. *Our success is measured by: research papers, conference presentations, and new proposed research grants.*

2. Student Support: Provide NASA competency-building education and research opportunities to develop qualified undergraduate and graduate students who are prepared for employment in STEM disciplines at NASA, industry, and higher education. Success was **Measurable** based on the quality of the applicant pool, research papers/abstracts, presentations at the annual Symposium, and a short report (or published abstract/paper) at the end of the support period. All awards were **Acceptable** by tying directly to NASA's strategic goals and objectives. All awards were **Realistic** by their being matched. We proposed the following **Specific** awards over a one-year (**Time Frame**) in 2013: *Full-year RISG Fellowships* at Brown (2) and our Affiliates (2); *RISG Summer Teaching Fellows* (at least 2); *RISG Summer Research Scholars* (at least 2 at Brown; 6 at our Affiliates); *Academic Year Scholars* at Brown (1) and our Affiliates (6); *RISG Graduate/Undergraduate Travel Grants*; Joint Industry Partnership (up to 1); *RISD Internships at NASA Centers* (4).

3. Course Development: We proposed to develop 4 NASA-related course resources for integration into STEM disciplines.

- a. **RISD Design Classes:** For the 2013-2014 academic year, the *Department of Industrial Design* proposed to focus on two classes the *Space Gloves* along with *Habitat designs in the Extreme Environment* coupled with internships awarded at the *JSC Habitability Design Center* (HDC).
- b. **Brown Engineering Systems Design Course:** We proposed to support a workshop for educators emphasizing hands-on learning through focused projects.
- c. **Bryant University:** Funds were allocated for 1 NASA-relevant curriculum development as well as supplies and a visiting speaker.

4. Travel Grants

- a. **Student Field Experiences** (Lead): We proposed to continue a popular undergraduate Spring Field Trip where undergraduates are immersed in field studies while using NASA materials (remote sensing and planetary analogs).
- b. **Affiliate Travel:** We proposed support grants to NASA Centers across the consortium.

5. Targeted Institution Research and Academic Infrastructure: We proposed to host a program for a faculty member from a Tribal College, which is part of the Nebraska Space Grant Consortium. The program was designed to engage Native American faculty members in culturally relevant STEM-related fields using culturally relevant NASA themes.

Outcome 2: *Higher Ed programs and Pre-College Programs*

1. Educator Professional Development:

- a. **Museum of Natural History (MNH):** 3 Educator workshops were planned at our Affiliate, the *Museum of Natural History*, all tied to 2 proposed RISG-co-sponsored exhibits.
- b. **Teacher Partnership Program:** Our 75:25 (75% Research to 25% Outreach) Program engages our RISG Fellows and Scholars through partnerships with RI K-12 teachers. They bring their current NASA-focused research into the RI classrooms, thereby providing a context to classroom materials.
- c. **Brown Summer Academy:** We proposed to support 3 classes for middle and high school students, 2 given by RISG Summer Fellows. This also enhances the teaching skills of the graduate students.

2. Curricular Support Resources: Our Affiliates (Museum of Natural History and the Ladd Observatory), Fellows, and Low-Gravity Program provide resources for students and mentoring through our outreach programs. We proposed to continue sharing research results and experiences with students through class visits, public speaking (e.g., local astronomy clubs), and special seminars.

3. Student Involvement K-12: Most of our involvement is through programs provided by our Affiliate, the *Museum of Natural History*. In addition, our Fellows and Scholars interact with K-12 students through their participation. This experience, however, is primarily to provide teachers with STEM materials and to develop tools for informal-education skills that can be used as they become professional researchers.

- a. **Gaudet Middle School Planetarium and Cormack Planetarium:** The *MNH* Director proposed to develop new STEM-based (and NASA-themed) programs for the Krupowicz Planetaria (Gaudet Middle School) using resources provided by RISG-sponsored NASA programs.
- b. **NASA Mission-related Outreach:** Fellows, Scholars, and faculty involved in NASA missions engage K-12 by describing their experiences and the need for academics in order to achieve their dreams of participating in the exploration of other worlds.

2. Professional Development for Informal Education Providers:

- a. **Fellows and Scholars Teacher Partnerships:** We proposed this program specifically to sustain involvement by past Fellows and Scholars in informal education, even after their fellowship ends, through small travel grants.
- b. **Professional Development:** We proposed to support travel by informal education providers at the Museum of Natural History to NASA-related workshops and NASA-Center travel.

Outcome 3: General Public and External Relations programs

1. Resources:

- a. **NASA-themed exhibits:** We proposed one new exhibit at the Museum of Natural History.
- b. **Ladd Observatory Outreach Program:** We proposed weekly views of current hot topics in astronomy along with hosting annual Public Open Houses.

2. Professional Development for Informal Education Providers:

- a. **Fellows and Scholars Teacher Partnerships:** We proposed this program specifically to sustain involvement by past Fellows and Scholars in informal education, even after their fellowship ends, through small travel grants.
- b. **Professional Development:** We proposed to support travel by informal education providers at the Museum of Natural History to NASA-related workshops and NASA-Center travel.

PROGRAM/PROJECT BENEFIT TO OUTCOME (1, 2, & 3)

Provide concise, meaningful highlights or anecdotes (no more than three) that are directly related to work completed in 2013, highlighting student and/or project accomplishments. Specify alignment to an Outcome.

A. EquiSat

A group of students became very excited by the CubeSat launch opportunity. As a result, they formed an informal group dedicated to design and build an open-source and low-cost nanosatellite, in accordance with the CubeSat architecture commonly implemented by many university satellite programs. Their CubeSat (called EQUiSat) carries a primary payload of an LED array, which will be visible on Earth with an apparent magnitude of 2, approximately that of the North Star, Polaris. Additionally, EQUiSat carries a radio transceiver operating on Ham frequency bands, which can be easily tracked by amateur radio receivers. Their primary mission is to increase public interest in space applications. The inherent visibility of our satellite, coupled with the use of an amateur radio will allow the public to interact with our satellite in a new and unique way. They are also developing educational outreach programs to teach students about space and aerospace design. These lesson plans will enable students to make and understand aspects of their satellite and will culminate with an opportunity to easily locate, hear, and see EQUiSat in the night sky. The team constructed (from scratch) most of the elements, not only to reduce cost but also to develop hands-on experiences in engineering, from design to machining to integration. The team was just selected for launch in 2017!

B. International Genetically Engineered Machine (iGEM) Competition

Communication is an integral part of life as we know it. Over the summer of 2013, the iGEM team pursued four synthetic biology projects with the goal of improving communication across different media. On the atomic level, their **BioWires** project created silver-incorporating DNA strands to use as nanowires, which could improve the cost and effectiveness of electronics. Their **CRISPR** project worked on a system for passing DNA regulatory messages between cells to create transmissible vaccines. They also extrapolated proteins from the past to better understand early life on Earth for their **De-Extinction** project. Finally, they built a sucrose biosensor in *B. subtilis* that is scheduled for launch on the **EuCROPIS** satellite into low-Earth orbit. With a medal-winning performance at the North American regional synthetic biology competition in Toronto, the team of students at Brown and Stanford universities headed to the World Championship Jamboree of the iGEM (International Genetically Engineered Machine) competition at MIT Nov. 1-4, 2013. Advised by Brown faculty members Gary Wessel and Lynn Rothschild (NASA Ames, also Adjunct at Brown), the cross-country collaboration worked on four projects with a theme of biosynthetic communication. The team included students from biomedical engineering and bioelectrical engineering. Their website is: <http://2013.igem.org/Team:Stanford-Brown>

Over the last report period, the Brown-Stanford Team accomplished the following:

- Demonstrated silver-ion incorporation in the DNA double helix
- Worked with NASA and the German Space Agency to develop BioBrick constructs for the EuCROPIS Satellite Mission (they will be the first to test synthetic biology in space)
- Isolated and bricked components of two CRISP-Cas systems
- Designed and modeled ancestral proteins to understand early conditions of Earth
- Collaborated with Dr. Rich Lenski to use 25 years of evolutionary data to model and text bionformatics software
- Collaborated with UC Davis Team to characterize promoter strengths
- Instructed high school seniors in the basics of synthetic biology and how to build an iGEM team
- Demonstrated SynBio and iGEM to the public at Maker Faire in SF and NYC
- Curated iGEM memes with additional social outreach via Instagram and Twitter
- Produced iGEM podcast to discuss SynBio topics

At NASA Ames, the iGEM Team met with Dr. John Holdren Director of OSTP (Assistant to the President for Science and Technology STEM Education and the Administration) who was impressed with their efforts.

PROGRAM ACCOMPLISHMENTS

Refer directly to the consortium goals and SMART objectives in your 2010 base proposal when describing your accomplishments.

Outcome 1: *Contribute to the development of the STEM workforce in disciplines needed to achieve NASA's strategic goals:* (Discussion of achievements and progress related to your Fellowship/Scholarship, Higher Education and Research Infrastructure programs). (*Employ and Educate*)

Goals: The *first* goal of our Fellowship/Scholarship Program is to engage, inspire, and motivate graduate and undergraduate students in the process of research and discovery, thereby providing relevance to their academic studies and preparing them for post-graduate employment in STEM disciplines at NASA, industry, and higher education. Our *second* goal is to engage these students to public involvement in NASA's themes and missions in order to develop a sustained commitment to sharing NASA's research with their stakeholders. Our *third* goal is to develop and sustain future research programs through graduate support.

SMART Objectives:

Specific: Our Fellowships /Scholarships will be judged on the proposed research (including NASA relevance), grades, letters of recommendation, and past responsiveness of their advisors (for repeat requests). Balance will be sought across different departments, advisors, young faculty, gender, ethnicity, and relevance.

Measurable: Success will be measured by student engagement in our program, publications/presentations arising from this support (abstracts, papers, poster presentations, presentations at annual symposia), and continued involvement with our (or other SG) program. We also will assess evidence that they stay within STEM areas, regardless of their specific path (e.g., science education, research, or industry) through longitudinal tracking. Specific targets are highlighted with each program.

Acceptable: All of the awards will be tied directly to NASA's strategic goals and objectives. Any proposed effort not demonstrating a clear tie with NASA goals and objectives is not highly ranked.

Realistic: The number of Fellowship awards is governed by the ability for each university to identify a match through tuition awards or other means. We relax the Fellow/Teacher-Partnerships for our Affiliates, unless they choose to participate.

Time Frame: At the Lead Institution, Fellows are eligible after their first but before their last year of study with awards limited to one year in order to engage more departments and faculty. At our Affiliates, we relax the first and last-year requirement but require demonstrated relevance and academic quality and/or potential for success.

A. Fellowship/Scholarships:

Each award was competed under the categories noted below (*Specific*) and was directly related to NASA's mission and goals (*Acceptable*). Our primary metrics for our Fellows included the quality of the applicant pool, presentations at the annual symposium, and talks/papers/abstracts (*Measurable*). Awards fell within the budget and were matched (*Realistic*). Different awards covered different award periods and require separate applications (*Time Frames*).

1. Graduate Fellowships (6): A grand total of **6** graduate fellowships were awarded across the entire consortium (combining full-year and summer fellows). Of this total, made the following awards:

a. Lead Institution:

- 2 full-year graduate awards (1 underrepresented)
- 2 Summer graduate awards (1 underrepresented)

b. Affiliate Institutions

- 2 at Affiliate (both underrepresented)

2. Undergraduate Scholarships and Internships (15): NB: Limited institutional matching precludes participating in NASA Center internships through SOLAR. A total of **15** undergraduate awards were made including **6** female and 3 underrepresented.

a. Lead Institution (total of **8** awards) including:

- 1 Summer Scholarship;
- 2 RISG/UTRA Summer Assistantships;
- 4 NASA Ames summer interns (part of the Brown/Stanford iGEM Program).
- 1 AY Research Scholarship

b. Affiliates (total of **6** awards) were made including:

- 2 Summer Research Scholars: Bryant University
- 2 Summer Session: NASA-JSC Research Internships at NASA-JSC (part of the NASA-RISD/JSC Design class)
- 2 Winter Session: NASA-JSC Internships at NASA-JSC (part of the NASA-RISD/JSC Design class)

c. Brown/Tougaloo NASA Space Grant Summer Scholarship (1 award)

In total, we made **21** Graduate Fellowship and Scholarship awards. Note that we had proposed to make 27 total awards each year in our 5-year proposal. We did not meet this target due to increasing costs for students with a flat-lined budget, and shifts in opportunities for group engagements (e.g., *iGEM*, *EQUiSAT* programs). The breakdown from what was proposed (*italics*) and actually awarded this report period is as follows:

- *Proposed Full-year RISG Fellowships at Brown (2) and our Affiliates (2):* Awarded Brown (2); Affiliates (2)
- *Proposed Summer Graduate Fellows (at least 2):* Awarded Brown (2)
- *Proposed Summer Research Awards (>2 from Brown; 6 from Affiliates):* Awarded Brown (2 RISG/UTRA); Affiliates (0)
- *Proposed AY-Undergraduate Award (1 at Brown, 6 at Affiliates):* Awarded Brown (1); Affiliates (0)
- *Proposed Summer Undergraduate Scholars:* Awarded Brown (1); Affiliates (2)

- *Proposed Summer Undergraduate NASA Internships* (4): Awarded Brown (4); RISD (4)
- *Proposed Joint Industry Partnership* (1): Awarded none (no response this year)
- *Proposed Minority Serving Institution Summer Undergraduate Research* (1): Brown (1)

Disciplines involved in our program include: environmental science, chemistry, planetary geology, cosmology, physics, Electrical Engineering, and Biomedical Engineering. We met or exceeded our goals but could not meet our targets for Academic Year awards this year due to re-allocation of awards for NASA-Center summer programs and difficulty in establishing scholarships at one of our Affiliates related to administrative issues at that institution. Because of the Sequester and dramatic cuts in university research grants (or grant levels) from NASA, there was nevertheless an increase in the number of applicants. Space Grant provides one of the few safety nets to allow students to continue in their research program. The overall reduction in federal grants is causing students (both undergraduate and graduate) to re-evaluate their goals and it is reported that some are leaving STEM entirely (going into law, to Wall Street, or to oil companies) in order to be assured that they will have a job in the future.

A. Higher Education (HE)

Each year we allow the entire consortium to compete for new course development, student research efforts, course engagement (e.g., travel awards, field trips), and under-represented opportunities.

Goals: Increase students in STEM fields through (a) postsecondary curricula (b) meaningful hands-on experiences and increase involvement of women and under-represented and underserved groups in STEM careers.

Description: *SMART Goals and Objectives* for our proposed effort:

Specific: One-year awards will be based on clearly stated goals to develop, enhance, or integrate NASA-related programs into the undergraduate studies through new curricula, hands-on use of NASA materials, NASA competitions, or development of new approaches relevant to NASA programs.

Measurable: We measure success by a demonstration of student involvement, results (e.g., new class), connections with NASA Centers or programs, and demonstrated awareness within the university or department. Projects (class or individual) are reviewed at the end of the award (e.g., critical design reviews, written summaries, or presentations) and presented at the annual *RI-SG Symposium*.

Acceptable: Selection requires that proposals document consistency with NASA themes/goals, hands-on experiences (e.g., *Low-Gravity Flight Opportunities*, field excursions, industry partnerships, and collaborations with NASA Centers), documented match, and potential for growth or self-sustainability. All travel grants have to demonstrate need (not just visits), specific goals, or participation

(conferences or workshops). Interdisciplinary and collaborative approaches are encouraged.

Realistic: We require that proposed efforts can be completed within the proposed budget.

Time Frame: We make our awards for one year in order to engage more departments and faculty. All requests are necessarily tied to the academic calendar (not grant cycle). Consequently, some programs extend over two grant cycles.

1. Course Development: We did not meet our goal of 4 new or revised NASA-related courses this year, instead supported **3**. This reduction reflected our Affiliate Bryant University being able to expand their new graduate class offerings through a new EPSCoR-RID award this last year. Those classes supported by RISG met our SMART objectives: clear goals (*Specific*); hands-on student involvement; reviewed (*Measureable*); links to NASA themes or competitions with presentations at our annual Symposium (*Acceptable*); clear objectives and matched funds (*Realistic*); and awarded for one year (*Time Frame*). We provide opportunities for faculty to compete for innovative, hands-on classes directly tied to NASA themes and objectives. This year three institutions won awards, three at our Affiliates and one at the Lead Institution. All courses met our SMART objectives by: being having well-defined content in their proposal; measureable through publications and presentations; relevant by tying directly to NASA themes and programs; realistic and meeting time frames by being renewed each year with new objectives. Each course is competed each year and awarded on the basis of relevance, content, and funding level.

- a. **Rhode Island School of Design (RISD) “Design for eXtreme Environments: Designing Space” (ID-24ST-07):** During this report period, RISD offered a significant revision of a class “Design for Extreme Environments” which offered multiple opportunities for teaching/learning design and engaging with NASA while increasing students’ exposure to STEM. This year RISG supported a new six-credit course offered through the Department of Industrial Design and created with support from NASA personnel at the *Habitability Design Center* (HDC, NASA Johnson) and other divisions. This year the class focused on a moderate-fidelity, low-cost, innovative method (*Microgravity Repair Facility*) to simulate lower-than-earth gravity fields incorporating a simulated extravehicular activity (EVA) suit. Students from this class are selected internships at *NASA Johnson* during the summer and winter sessions. The students worked with a team from NASA to design & build models for a *Microgravity Repair Facility* for a long-duration mission beyond low-earth orbit that would see astronauts travel to the far side of the Moon, an asteroid, or even Mars.

This class uses the challenges imposed by extreme environments as a foundation for a pedagogical approach for teaching design. This effort is a model for the integration of design as a part of STEM and offers many relevant examples of the role that design and creativity can play in complex and highly constrained technical projects, as clearly demonstrated during past related courses offered in conjunction with NASA. These courses, internships and projects are a valuable and effective method for teaching design and help students learn essential skills for their future careers. Although not all design students go into aerospace or work for

NASA, designers play an increasingly important role in STEM fields, particularly in the technology sector. Through this class last year, RISG supported two interns at NASA JSC for ten weeks during the summer. In addition, two students were sent to NASA JSC for 5 weeks as part of the Winter Session (January, 2014).

Last year, we also reported on a new RISD course (“*Space Gloves for NASA*”) based on developing new EVA glove designs. This course was offered jointly through the departments of *Industrial Design* and *Apparel Design* and demonstrated that NASA was working deeper into the RISD curriculum. As a result of this new joint class, we note that a student from the *RISD Textiles Department* went to JSC for summer 2013 for the first time ever.

- b. **Brown University iGEM:** This seminar (*BII980/1960*) focuses on new themes each year related to the *International Genetic Engineering Machine* in order to meet the international challenge. It is a joint effort engaging faculty and students Brown and Stanford working with personnel at NASA Ames. We contribute to summer internship at NASA Ames for the class, as well as funds for domestic travel to national competitions during the Academic Year. A full description of this effort can be found under “Benefit to Outcome” above.
- c. **Bryant University Initiative:** The *Department of Science and Technology* had planned to offer new courses in an effort to integrate more NASA themes into the curriculum at the graduate level (specifically targeting “Global Environmental Studies”). This Affiliate chose to put all new graduate courses under a new EPSCoR-RID that was funded this year.

2. RISG Graduate/Undergraduate Travel Grants: We awarded **8** travel grants to graduate and undergraduate students for enabling or stimulating their research: research travel awards and conference travel. Such travel grants are extremely important for defining careers and are leveraged by departmental and institutional grants. Each award required written justification, NASA relevance, and evidence of active participation (presentations, posters, reports).

3. Undergraduate Engagement:

- a. **NASA 2014 NASA Rover Challenge:** A project conducted throughout the 2013/14 Academic Year created a competition entry for the upcoming (April) *NASA Rover Challenge* at *NASA Marshall Space Flight Center*, in Huntsville, Alabama. This project is designed as a yearlong, student-led interest club. This will be RISD students’ fourth entry into a NASA competition. RISD’s first entry into the *Moonbuggy* race was the result of a class taught by Professor Michael Beresford, and was extremely successful, placing third in the college division and receiving the “Best Newcomer Award.” Last year the informality of a club resulted in a mechanical failure. This disappointment, however, was not considered a failure in learning because some had predicted the potential failure (but not followed up). The students are now motivated more than ever.
- b. **EquiSat:** As noted in the highlights, a group of students in engineering at Brown initiated their own team to design and build a *CubeSat* (outside of the classroom). The students applied what they had learned in their capstone Engineering class (initially supported by Space Grant) focusing on systems engineering. RISG

provided support for materials and information about possible opportunities for launch. This program has so far engaged 28 team members: 10 alumnae (4 of which are founders). Concentrations include electrical engineering, mechanical, civil, computer, history, computer science astrophysics, and economics.

c. **Biosonar guidance of Flight in Complex Surroundings:** This research effort (also at Brown) addressed a core objective for NASA in designing and building autonomous vehicles for exploration of environments, servicing structures, and transport of personnel and materials. Success in this effort demands solving complex problems of sensor-directed navigation and guidance, particularly using radar or sonar so operation is feasible in the dark. The proposed project examined the mechanisms by which echolocating bats fly in cluttered surroundings and steer their flight using information derived from their left-pointing and right-pointing side-looking sonar systems. The award engaged an under-represented minority student in hands-on research experience, guided through an independent study.

- First, we supported 12 undergraduate students (Wheaton College) for a geoscience field course in Death Valley, California. The field project was tied to a new experimental class. The students built on their introductory geology experience to explore areas in geomorphology, sedimentology, structural geology and petrology.
- Second, we supported a spring-break geology field trip to Texas and Mexico at Brown University. The trip engaged 20 undergraduate students, 2 graduate students and one professor. They visited McDonald Observatory located in the Davis Mountains as well as White Sands National Monument located in New Mexico Tularosa Basin. Success was measured by relevance, direct contact with NASA personnel, oral/poster presentations and written student responses.

d. **Wheaton College:** Space Grant supported a dynamic exhibition titled “*Inner and Outer Space*” Including the work of Monica and Tyler Aiello. They have pioneered innovative STEAM education uniting Science, Technology, Engineering, Art and Math. They led a workshop for science and arts students and faculty. The opportunity to participate was offered throughout the consortium.

4. Minority-Serving Institutions (MSI): Rhode Island does not have a minority-serving institution of higher learning. Nevertheless, we developed a strategy to bring students from an MSI in Mississippi (Tougaloo) and explored a parallel program for a tribal college.

- a. *First*, we partnered with the Brown/Tougaloo exchange program and competed a summer research opportunity students from Tougaloo. Faculty members at Brown were asked to define a problem for a student to work on. Based on letters of recommendation, CV, and phone interview, the Brown faculty member selected a student from the computer science department at Tougaloo. The successful student (from computer sciences) worked with a Professor in Physics/Astronomy on a project related to observational cosmology. Our initial program included small stipends for the faculty member and a visiting Tougaloo faculty member in residence over the summer in order to ensure mentoring for the project and for the change in environment. The student received a stipend (RISG), a meal plan (Brown

match), travel (Brown match), and housing (Brown match) for the period. Based on this experience, we are reducing the faculty stipend next year (at the request of the Professor) but plan to retain the support for the in-residence advisor from Tougaloo. The participating faculty has signed up for another student this summer and at least two other faculty members (Brown and RISD) have expressed interest. Because of funds, we hope to support one student at Brown and one at one of our Affiliates.

- b. *Second*, we worked with the *Associate Provost for Academic Development and Diversity* to establish a summer appointment for a faculty member of a tribal college to work with a Brown researcher. While this was not established, we did admit a faculty member to a graduate program from a tribal college in North Dakota (Turtle Mountain). This student has direct experience participating in this type of program but recommended that we offer a 3-week in-residence activity followed by continued work on the project back at the tribal college. He also agreed to help mentor the program this coming summer.

5. University Teaching and Research Award (UTRA) Supplements: We partner with an existing program for hands-on research experiences at Brown University. When a student applies to a Brown research program with a NASA-relevant theme, we provide a small supplement in order to make NASA-relevant research more attractive. This year we provided small supplements to 2 UTRA student awards to undergraduate students at Brown. Note that the numbers for this partnership are included in the summary of awards above.

C. Research Infrastructure

Goals: The goal of our research infrastructure program is to encourage research that can be integrated into training students and develop new directions and opportunities relevant to NASA's goals and missions.

The *Research Infrastructure Program* at the Lead Institution remains limited due to the funding level for this budget call and the absence of committed matching funds. Consequently, we primarily award a limited number of *Seed Grants* where this match can be clearly identified through existing industrial partnerships, foundation awards, or new departmental initiatives.

SMART Objectives

Specific: Seed Grants will be awarded for one year (typically over the summer when time is available). Awards will be based on relevance to NASA themes and goals, reasonableness of the budget for the proposed tasks, need (e.g., concept development or bridging between grants), absence of existing NASA funding for proposed tasks, and relevance.

Measurable: Our metrics for success include any or all of the following: increased involvement by faculty in NASA research programs as well as written summaries of outcomes, published results, involvement of graduate/undergraduates in NASA-related research, new proposals submitted to NASA, and/or papers presented at professional meetings-workshops or our annual symposium (whether orally or in a poster).

Acceptable: Each proposed award will be based on the following: (i) relevance to NASA goals and objectives; (ii) their potential for seeding new grant opportunities; and (iii) the involvement of new participants and students in the effort; and demonstration of a collaborative or cooperative interdisciplinary theme. We add merit if they can demonstrate collaboration with an existing NASA program or Center.

Realistic: Proposals are ranked according to likelihood for results evidenced by a new proposal to NASA or graduate student after the award period. Our grants provide only seed funds (< \$10K).

Time Frame: We limit awards for one year in order to engage more departments and faculty.

1. Affiliate Faculty and Research Support: Our specific goal each year is to enhance and deepen NASA-related research through small seed grants limited to <\$10K per investigator (excluding undergraduate research support) for 5 grants. All proposed research efforts are competed each year across the entire consortium and had to identify relevant NASA themes with documented matching non-federal funds. Over the last year, we funded only 2 research seed grants during the report period, all at our Affiliate institutions. Consequently, we did not meet our target. This reduction in awards has three causes: (1) new and expanded opportunities through NASA-EPSCoR; (2) difficulties related to administrative shifts in matching funds; and (3) revised commitments for other programs while being level funded.

a. **Roger Williams University:** *The Numerical Solution of Helmholtz Equation for the Superellipsoid via the Modified Galerkin Method for the Impedance Boundary Value Condition.* The objective is to find the numerical solution of the Impedance boundary value problem for the Helmholtz equation for a smooth superellipsoid. Results were presented at the RISG Symposium, thereby satisfying this SMART goal (“Measureable”). The topic has direct NASA connection by creating an approach addressing micro-turbulence (Specific). Finally, the grant was “Acceptable” because it directly addressed relevance (i.e., micro-turbulence), was “Realistic” by being less than \$10K, and met the time frame requirement.

b. **Providence College:** We supported a faculty member at Providence College (Physics) to work with faculty at Brown University engaged in a NASA-EPSCoR Competitive Research Award. This “Specific” award on thin film research (enabling better batteries) was provided during her sabbatical and extended into continued summer research. Results are being incorporated into a joint publication, thereby satisfying our Measureable metric. It was “Realistic” because the award was less than \$10K, “Acceptable” by being highly relevant and collaborative, and met the “Time Frame” by being reviewed for only one year.

1. Lead Institution Faculty and Research Support: Our annual objective was to support 2 seed grants at the Lead Institution. We did not meet this objective due to other priorities in supporting our Affiliates and increased costs while level funded. The one program we did support was the *Space Horizons Workshop* (at Brown). This is a one-day workshop designed to engage innovative thinkers for future space exploration. This year the topic is “Space Infrastructure” where participants explored ways that space missions

can make use of pre-positioned resources in space in order to minimize cost and complexity. The workshop is conceived and hosted through Brown University's *School of Engineering* and researcher in the Department of Geological Sciences. This workshop also meets our objectives and criteria above including specific effort (the workshop); relevance (key NASA theme); time (reconsidered each year); cross-disciplinary (engineering, industry, geology); realistic (seed funds only, <\$10K); and acceptable (presented outcomes on the web and at the annual Symposium).

Outcome 2: *Attract and retain students in STEM disciplines through a progression of educational opportunities for students, teachers, and faculty:* (Discussion of achievements primarily focused on your Higher Education programs not discussed in Outcome 1 and your Precollege programs). (*Educate and Engage*)

Goals: (1) Inspire and motivate educators to incorporate aerospace themes into their classrooms; (2) Engage undergraduates and graduate students in formal and informal education in order sustain their future involvement, whether as faculty researchers or educators; and (3) Engage graduate students in the excitement of their research through communicating their NASA-related results.

SMART Objectives

Specific: We seek to support three *Educator Workshops* each year structured around the new exhibits at the *Museum of Natural History* (Roger Williams Park, City of Providence) (2) Provide travel support for our professional education providers at the MNH to NASA-relevant workshops and NASA Center activities that provide meaningful materials for distribution. (3) *Teacher Partnership Program* connecting RISG Fellows/Scholars with K-12 teachers.

Measurable: Success will be measured by the following: (1) *Educator workshops:* educator responses to questionnaires, repeat participants, and solicited feedback on the use of material in the classroom, and whether in the classroom or through informal settings (e.g., clubs). (2) We will assess success of travel support by the documentation that materials have been implemented into workshops or programs at the museum. (3) *Teacher Partnership Program:* assessed by graduate student participant and teacher responses to questionnaires classified into three categories: successful, moderately successful, and unsuccessful.

Acceptable: (1) Our emphasis on professional development features hands-on exercises consistent with *NASA's Education Strategic Coordination Framework*. The *RI-SG* and the *MNH* staff include 2 full-time professional educators trained in STEM-based education programming. They work with NASA's *Aerospace Education Specialist* from *NASA Goddard* (Rick Varner). (2) All workshops will involve NASA themes and resources. (3) The *Teacher Partnership* program addresses our goal to engage students in higher education with RI educators by incorporating NASA themes and enhancing their preparation in the classroom by distributing standards-based education materials.

Realistic: Our target under this award is to engage at least 40 educators through our workshops or through other professional development, such as our *Teacher Partnership* programs.

Time Frame: All programs are for one year, with no-cost extensions when adequately justified.

1. Educator Professional Development: Our goal this year was to support 3 NASA-content educator workshops. We exceeded this goal by supporting 25 workshops (engaging 215 participants) through partnering with the *Museum of Natural History* programs.

- a. ***Museum of Natural History (MNH) Programs:*** The *MNH* supports NASA-themed workshops serving educators from across all of RI. Last year they offered 25 educator workshops for approximately 215 participants incorporating NASA themes. Hence, we exceeded our goals. NASA content is part of all of our programming. Of these workshops, 6 specifically focused on content and educational programming related to RISG-supported exhibits *Comet Tails* and *Dynamic Galaxies*. Both exhibits engaged a professor and PhD graduate student in Physics/Astronomy in order to add content (and context for the exhibits), while Museum staff provided supplemental teaching materials and strategies. In addition, the Museum's Director facilitated a series of 4 STEM-based learning experiences, utilizing NASA resources, for middle school teachers. Finally, the Museum facilitated 4 STEM workshops for formal and informal educators from *Afterschool Programs*, *Providence After School Alliance*, home-school families and scout groups. RISG supports these efforts through materials, content, and exhibit support (Outcome 3 below).
- B. ***Krupowicz Planetarium Programs:*** The *MNH* Director also works with the Middletown School district to engage middle-school students and teachers through programs at the *Krupowicz Planetarium*. This last year she supported a series of 15 workshops engaging 40 teachers. These workshops integrated NASA themes into curriculum activities: *What Comets can teach us*, *Space Weather*, *Being in the atmosphere of the Sun*, *Mars, The Red Planet Our Place in Space*, *A look at our Sun*, and *A look at our Moon*, *Our Changing Climate*, *Technology and Missions Earth*.
- c. ***LEGO Workshop:*** Last summer, we supported two teachers to participate in a LEGO workshop offered through *Tufts University* as part of a *Regional Space Grant Initiative*.

2. Curricular Support Resources: Graduate Fellows participate in a teacher partnership where they make in-class presentations covering a NASA theme. This strategy engages the graduate students in oral presentations, which enhances their speaking skills, while informing/providing educators with supporting materials. This year, our Fellows made three presentations at local schools this year, engaging over **250** students.

3. Pre-College Summer Courses: We supported **3** on-campus classes (matching our goal of 3) for pre-college students through Brown's Office of Continuing Education for middle and high school students. Two of the classes were specific to Lego Mindstrom robots, the first class was "Robot C, Robot Do: Programming Lego Robots with a Text based language", and the second, Robot C: An Introduction to Programming using Lego Robots." The third course, "Habitable Worlds: Possible Places for Life in the Solar System and Beyond" was taught by two Space Grant Fellows.

4. Student Involvement K-12: We met our goals through programs at the *Museum of Natural History*. Advanced STEM programming at the *MNH* aligned with state Science Grade-Span Expectations (GSEs). Over the last year the *MNH* engaged 7,321 school children (~7% increase from last year), 625 children in camp/after-school programs (11% increase), and 135 girls in Girl Scout programs (12% increase). NASA content is part of all programming.

- a. ***Krupowicz Planetarium (Gaudet Middle School) Partnership:*** The *MNH* has an outreach program across the Bay to engage students at the *Krupowicz Planetarium*, attached to Gaudet School. The planetarium uses hands-on experience for middle school students (2,234 students this year), as well as teachers. Using Museum and NASA resources and the *Krupowicz Planetarium* students at Gaudet Middle School and Learning Academy engage in hands-on, authentic learning experiences facilitated by the *MNH*'s Director. These enriching experiences support (and are embedded in) the curriculum mapping for the Middletown Public School District. The activity was highlighted in regional newspapers.
- b. ***NASA Mission-related Outreach:*** Exhibits (see below) at the *MNH* explicitly incorporated NASA mission results. Museum staff incorporated available on-line content for visitors through school tours in order to underscore NASA's role in exploration.

5. 3D-MakerBot Project: This effort focused on using objects to enhance learning of space science. As a result of the response at the Geological Society of America national meeting in the prior year, a paper was submitted and accepted by the *Journal of Geoscience Education* where discussed the potential role of 3D printing in the classroom.

6. Summer of Innovation: Providence was the primary recipient of the SOI grant through one of our Affiliate (not through RISG); nevertheless, we are reporting some of their successes here. There were 25 students and 6 educators. Through a partnership with the Providence Afterschool Alliance and the Providence Public School District, the Museum worked teachers and students in the Summer Scholars 4-week summer education program. This unique partnership paired middle school teachers with science, technology, engineering, and mathematics-focused informal educators like the Museum, to provide hands-on learning opportunities for middle school youth that will help curb summer learning loss. This 15-day (60 hour) enrichment camp integrated both mathematics and English language-arts into a hands-on STEM learning program. It integrated NASA resources and curriculum as part of the experiential learning experience for students. The program served the diverse and underserved urban population of Providence.

As part of our programming using NASA resources, including "NASA/PBS Design Squad Activities", students completed hands-on experiences that challenged them, while building their critical thinking skills. SOI Themes: *Designing for Space, Mars Explorations, Solar System Adventures*

Outcome 3: *Build strategic partnerships and linkages between STEM formal and informal education providers that promote STEM literacy and awareness of NASA's mission: (Achievements and progress of Informal Education programs). (Engage and Inspire)*

Goal: To inspire, engage, promote, and educate the public in NASA's mission through informal education at museums, observatories, and other resources.

SMART Objectives:

Specific: Three tasks were proposed in our 5 Year Proposal: (1) Support for the *Museum of Natural History* (Providence) to provide a new exhibit in the Space Room and continue development of a new exhibit hall on *NASA Earth Science/Climate Change*. (2) Work with Our Partners (Ladd Observatory and Northeast Planetary Data Center) to promote public events. (3) Promote NASA events through web and list-serve announcements.

Measurable: We proposed to assess impact by (1) Feedback forms with visitor comments and suggestions are monitored and used to ascertain the effectiveness of the Museum's programming, especially those related to the current exhibit. Changes are made to programming if deemed ineffective. (2) We proposed to assess our public events and open houses by press coverage and number of participants over the year. And (3) we proposed to measure the distributed information through press announcements, TV announcements, web hits, and list-serves.

Appropriate: All RI-SG sponsored exhibits (1), public events and open houses (2), and "docent" programs will align with NASA goals, missions, and themes.

Realistic: Although this proposed budget is small, the staff and resources of the museum (and our Partners) heavily leverage the proposed efforts. Our support also allows for planning, advertising, and leveraging through other funding sources.

Time Frame: Our programs are offered on an annual basis but can extend in case of unusual circumstances at no cost.

A. Resources: The *Museum of Natural History* (MNH, Providence) is our primary partner for broadening our reach for the public, educators, and students. The museum staff members are trained educators and address the state standards in all programs. Universities and Colleges work closely with the museum through Space Grant in order to provide content expertise. The museum is officially a Providence City museum but reaches the entire state (and the only museum of its kind in RI). It reaches a large underserved population through the surrounding neighborhood, visitors, school excursions, and educator involvement. In recent years, the RISG partnership with faculty at Brown and the Northeast Planetary Data Center has supported timely exhibits (typically 2/year) resulting in increased attendance and greater visibility of the museum and Space Grant.

1. Exhibits and Activities: The *Museum of Natural History* in Roger Williams Park (City of Providence) has a designated a room just for NASA content. We supported 2 new exhibits, thereby exceeded our goal of 1 exhibit for the year. The room dedicated to the *NASA Earth Science/Climate Change* has been put on hold due to structural repairs

necessary and improvements for the room. The prior year, Space Grant helped to bring in the Cassini exhibit as a fill in. This last year, we developed an entirely new exhibit about the upcoming Comet ISON (read below), rather than leaving the room empty.

- a. ***Dynamic Galaxies: Our Place in the Universe*** - After the success of a previous exhibit on the birth of stars and exoplanets, the same Brown Physics faculty member worked with the Museum to develop another exhibit. In this new exhibit the properties of galaxies was revealed, and what we've learned about the Universe from studying them. This new exhibit explores just some of the properties of galaxies, and what we've learned about the Universe from studying them.
- b. ***Comet Tails: Wondrous Wanderers*** -This exhibit coincided with the arrival of the comet ISON, and explores the historical and scientific importance of comets, and tells the story of the origin, composition, structure and fate of these messengers from the outer solar system. This exhibit was created through a joint effort with the Space Grant Director (Geology), a professor in Physics/Astronomy at Brown, the *Northeast Planetary Data Center*, and museum staff.
- c. **Attendance:** Museum attendance over last year was up by 2%, while the planetarium attendance was up 30%. This year, these exhibits attracted over 37,544 visitors. This increase in attendance is attributed to installations with new content and relevance. These percentages and number exceeded our objectives.
- d. ***Full Dome:*** Space Grant also helped the museum identify funds to install a full-dome capability in their planetarium. Full-dome programming will expand its programming function as a “Terra Dome” with the installation of a new “Earth Room.”

3. Engagement in RI Educational Programs: The MNH Director (Renée Gamba) and MNH Educator (Dawn Temple) continue to serve as *NASA Solar System Ambassadors*. She also serves on a number of panels and committees: *Providence After School Alliance STEM Advisory Team*; *Providence After School Alliance Experiential Learning Advisory Committee*, *Gaudet School STEM Team member* and *Middletown School Strategic Planning*. By serving on statewide committees, we ensure that NASA-themes get into the classroom in meaningful and in sustainable ways (including *Summer of Innovation*).

4. Ladd Observatory Outreach Program: Last June, Ladd Observatory hosted a major effort focusing on the Venus Transit. Because this effort was reported in last year's APD, we have nothing new to report on this cooperative program.

5. NASA Mission-related Outreach: Through our partnership, exhibits at the *Museum of Natural History* highlighted NASA missions: *Cassini-Huygens*, *Kepler*, *SOHO*, *SDO*, *STEREO*, *DIXI*, *Curiosity*, and *GALEX*. These exhibits are more than display; they provide relevant objects and content for visiting educators, students, and the public.

6. Krupowicz Planetarium: This planetarium is on the other side of Narragansett Bay from the *Museum of Natural History* (MNH). Through the efforts of Space Grant, the Director of the *MNH* has partnered with this small planetarium at a middle school, which now functions as local resource that broadens the reach of NASA-related activities. Over the last year, the Krupowicz Planetarium hosted 5 *Family Fun Nights* reaching about 215

people. In February 2014, they held a “Moon Day” for invited guests featuring actual moon rocks.

7. Public presentations: Various members of the RI-SG family gave public presentations, including talks at local astronomy clubs and conventions. Space Grant was highlighted at the public Open House celebrating the 250th anniversary of Brown University.

B. Professional Development for Informal Education Providers

1. Summer Fellows: Selected graduate students (working with faculty mentors) develop a one-week NASA-themed class over the summer, for pre-college students (middle and high school). Last year 2 graduate students developed and presented a course entitled “Habitable Worlds: Possible Places for Life in the Solar System and Beyond.”

2. Professional Development Travel Grants: The Museum Director, Outreach Krupowicz Planetarium Coordinator/NASA JPL Solar System Ambassador and Educational Curator traveled and participated in programming at the Kennedy Space Flight Center and astronaut hall of fame. Enhancing Professional Development workshops for informal and formal educators. Our Affiliate Representative at the University of Rhode Island also attended Annual Meeting of *Chemical Engineering* (CA) through RISG where she Chaired the Education Division "Reaching Diverse Audiences: K-12 to Graduate level. There were 7 seventeen-minute presentations covering STEM activities at the primary, secondary and post secondary level.

PROGRAM CONTRIBUTIONS TO NASA EDUCATION PERFORMANCE MEASURES

- **Student Data and Longitudinal Tracking:** Number of program student participants employed by NASA, aerospace contractors, universities, and other educational institutions; Number of undergraduate students who move on to advanced education in NASA-related disciplines; Number of underrepresented and underserved students participating.

Fellowships/Scholarships = 21; Higher Education/Research Infrastructure = 10; All awardees are continuing their degree program; we had 6 underrepresented students participating this year.

- **Minority-Serving Institution Collaborations:** Summarize interactions. Reference the names of projects with MSI collaborations.

Rhode Island does not have a Minority-Serving Institution of higher learning. Last year we initiated a partnership with the *Brown-Tougaloo Summer Program* in

order to bring students to Brown over the summer in order to work with a faculty member. This program supports students who wish to take classes at Brown over the summer, but we used this existing program to offer an additional student experience in hands-on research. This program is called the *Brown-Tougaloo NASA-RI Space Grant Summer Research Program*. We solicited proposals from faculty and then distributed the description to students at Tougaloo. The faculty member then interviewed the students (by phone) and selected the student with the best match of background and interest. The *Brown/Tougaloo Program* provided travel expenses and a meal program (on campus). While on campus, the students stayed in University dorms with RISG providing a stipend. We also gave a small stipend to a Visiting Faculty member on campus from Tougaloo, who acted as an on-campus contact and to the faculty research mentor. This last summer, one student was selected to work with a Brown University Physics/Astronomy professor. From the pool of students, the Brown/Tougaloo program supported an additional student as well. From all reports (faculty here and there as well as the student's report), this was highly successful, and we are offering this program again this year (already have 3 faculty mentors). In addition, we are encouraging our Affiliates to offer a similar program at their institutions in order to broaden our reach with MSI's.

- **NASA Education Priorities:** *Accomplishments related to the “Current Areas of Emphasis” stated in the 2010 Space Grant solicitation. Report on areas that apply to work proposed in your proposal and budget.*

- Authentic, hands-on student experiences in science and engineering disciplines – the incorporation of active participation by students in hands-on learning or practice with experiences rooted in NASA-related, STEM-focused questions and issues; the incorporation of real-life problem-solving and needs as the context for activities.

Our Fellows and Scholars are engaged in hands-on research directly related to NASA-relevant research. In addition, we offer or support programs that directly engage students in hands-on activities through the classroom (e.g., *Design for eXtreme Environments* class at *Rhode Island School of Design*, *International Genetically Engineered Machine* at Brown), competitions (e.g., Moonbuggy competition at NASA Marshall, CubeSat Opportunities), and in the field experiences (Brown and Wheaton). We review their involvement through reports at our annual Spring Symposium and written summaries of progress.

- Diversity of institutions, faculty, and student participants (gender, underrepresented, underserved).

We sought diligently to increase the diversity in our program over the last year through active recruitment and initiating new programs. Of the 21

fellowship and scholarship awards, 48% were women and 29% were from underrepresented groups. These percentages significantly exceeded our targets described in our 2010 proposal (40% and 10%, respectively).

- Engage middle school teachers in hands-on curriculum enhancement capabilities through exposure to NASA scientific and technical expertise. Capabilities for teachers to provide authentic, hands-on middle school student experiences in science and engineering disciplines (see above).

Our primary source for middle-school teacher involvement is the *Museum of Natural History (MNH)*, City of Providence). Exhibits at the museum provide content tied to educator workshops at the Museum. The MNH offered 25 educator workshops for approximately 215 participants. In addition, the Director of *MNH* works with our partner *Krupowicz Planetarium* in Middletown RI (across the Bay). Over the last year, this program engaged 40 teachers through a series of 15 workshops. This extension effort is part of the *Summer of Innovation* award.

- Summer opportunities for secondary students on college campuses with the objective of increased enrollment in STEM disciplines or interest in STEM careers.

Brown University offers a *Summer Studies Programs* for pre-college (middle and high school levels). This year two Space Grant Fellows and Associates develop and present a one-week course for juniors and seniors focusing on the NASA theme of astrobiology entitled “Habitable Worlds: Possible Places for Life in the Solar System and Beyond.” The course was hugely successful and will be offered again this summer.

- Community Colleges – develop new relationships as well as sustain and strengthen existing institutional relationships with community colleges.

Although interact with our Community College Affiliate, but have not initiated a new program this year due to her very active schedule. We do plan to submit a proposal to NASA if a Community College focus opportunity arises.

- Aeronautics research – research in traditional aeronautics disciplines; research in areas that are appropriate to NASA's unique capabilities; directly address the fundamental research needs of the Next Generation Air Transportation System (NextGen).

We contributed to this area of emphasis through a research seed grant to a faculty member (Roger Williams University) who is developing new

numerical solutions to the Helmholtz equation applicable to studies of boundary layers and turbulence.

- Environmental Science and Global Climate Change – research and activities to better understand Earth's environments.

Bryant University has a growing environmental science curriculum and research program. Research emphasizes climate change expressed by carbon and hydrogen isotopic records. Undergraduate and graduate students are contributing to the effort.

- Enhance the capacity of institutions to support innovative research infrastructure activities to enable early career faculty to focus their research toward NASA priorities.

We significantly reduced our research seed grants this year because of other emerging programs and shifts in emphasis by our Affiliates as they engage in EPSCoR-RID opportunities.

IMPROVEMENTS MADE IN THE PAST YEAR

Succinctly describe improvements and/or adjustments made last year that demonstrate significant change(s) within the consortium. The improvements and/or adjustments that brought about change may have been in management, resource allocation, project design, project evaluation, etc.

A. Management Changes:

In response to our mid-course Improvement plan, we proposed that we would seek improvement in our diversity, both in our fellowship/scholarship awards and in our involvement of Minority Serving Institutions. As described above, we increased the diversity in our tracked fellowship and scholarship award and exceeded our targets. As spelled out in our 5-year proposal (2010), our target for women was 40%. Over FY13, 48% of the significant awards were women. For underrepresented groups, our target was 10%; this year we achieved 29% participation. We had recognized this weakness in our program, even before the review and aggressively sought balance this year.

In addition, we initiated a new summer program designed to bring a student from *Tougaloo College* for a hands-on summer research experience. We talked directly with the *Mississippi Space Grant* Director in order to be sure that we did not interfere with any of their programs, and he welcomed this additional opportunity for his state. The details of this plan are outlined above. Here we note that the project focused on the search for gravitational lensing revealed by distortion in distant galaxies. The selected *Tougaloo*

student had experience in computer sciences. Here we simply confirm that it was a complete success with our faculty from last summer at Brown already signing up for next year, along with a faculty member in Computer Sciences has signed up. The one thing we will change (at the urging of our participating faculty) is to reduce the summer stipend for the faculty mentor. We agreed and will reduce that stipend but keep a certain level in order to ensure faculty buy-in. Our target, therefore, is to support 2 students from *Tougaloo*.

Our second effort focused on engaging a tribal college faculty member with a relevant project on the Brown campus. Although we had an agreement with the *Associate Provost for Academic Development and Diversity* at Brown, this particular effort was unsuccessful this year. Nevertheless, we are working directly with a past faculty member from a tribal college (now at Brown) who is very interested in developing this program and has had experience in the past.

We also will expand this program in the coming year and encourage our Affiliates to seek similar partnerships. Moreover, the RISG Director reached out to an African-American faculty member in computer sciences at Brown for future engagement. At the time, he was on sabbatical and could not participate last year but will this year. Moreover, this conversation led to a suggestion that he might submit a proposal to the *NASA-EPSCoR Competitive Research* opportunity and that we include engagement with under-represented groups in that effort. This grant was selected and already has received considerable press.

In summary, we have succeeded to increase participation by both students and faculty in working with under-represented students and look forward to greater participation in the coming year.

B. Resource allocation adjustments:

The increased support for our MSI initiatives and increasing needs from the CubeSat project at Brown were both at the expense of our research seed support. We also had to reduce our support this year for the RISD effort, reflected in the decreased scope (one class versus two this year). In addition, our Affiliate Bryant University is now receiving funding from a NASA EPSCoR-RID in order to develop a graduate program in environmental sciences. This means that support for graduate students and graduate courses started to transition over to that program this year.

PROGRAM PARTNERS AND ROLE OF PARTNERS IN PROJECT EXECUTION

List the institutions that comprise the consortium; include the name, type of institution, key characteristics, and role.

Brown University: Lead institution. This is a private university with a variety of undergraduate and graduate degree programs. Given that the grant is based here it is fairly involved with the grant and providing support.

Bryant University: Private university. Their relatively new programs in Environmental Sciences and Biology have begun to flourish and receive strong institutional support especially as they are learning how RISG can benefit them.

Community College of Rhode Island: Community college. This two-year community college provides opportunities for re-training and a stepping-stone to a four-year institution (including Brown).

Graduate School of Oceanography: *GSO* is part of the state-supported *University of Rhode Island* system (Narragansett Bay campus) exclusively for graduate studies and research on oceanography. They are the *Sea Grant* Lead for the state. Their NASA research includes remote sensing, astrobiology (past *National Astrobiology Institute* Lead), and climate.

Providence College: Four-year liberal arts institution. This past year their Affiliate Representative has received some seed funding from RISG and has started to gain an enhanced understanding of the program.

Rhode Island College: Primary training institution for teachers in the state. It houses the NASA's *Educator Resource Center*.

Rhode Island School of Design: *RISD* is a nationally ranked private college in the arts and design. *RISD* has been a very active of the consortium through innovative curricula linking industrial design classes with NASA centers (JSC, KSC).

Museum of Natural History: *MNH* is funded by the *City of Providence* and is located in historic Roger Williams Park. It contains the *Cormack Planetarium* where NASA-related programming is often featured. This museum features rotating NASA-themed exhibits and programs and offers supporting educator workshops and K12 programs.

Roger Williams University: *RWU* is a private institution (MAT, Masters of Public Administration, Architecture, Law, Criminal Justice) with growing programs in environmental and international studies

Salve Regina University: University offering PhD in the humanities. They offer a number of programs in the STEM fields.

University of Rhode Island: Lead state-supported undergraduate/graduate institution (identified here as "*URI*") and a *Land Grant* institution. *RISG* supports students and faculty in engineering and geology. They will host the RISG Symposium.

Wheaton College: Private liberal arts college with several faculty members who are involved in NASA-related research (studies into the satellites of the outer planets (using Galileo and Cassini data), astronomy, and environmental science.

Other Partners: In addition to our formal Affiliates, *RISG* has active partners including the:

Northeast Planetary Data Center (*NEPDC* at *Brown*) is funded through NASA's Planetary Geology and Geophysics Program and is an active partner through cooperative programs (exhibits) and access to planetary image data.

Ladd Observatory: Ladd provides weekly notices on topics related to astronomy as well as lectures and special events.

Krupowicz Planetarium: This planetarium is located at one of the schools within the Middletown Public School System and provides an outlet for increased outreach.

The National Space Grant Office requires two annual reports, the Annual Performance Data Report (APD) and the Office of Education Performance Measurement System (OEPM) report. The former is primarily narrative and the latter data intensive. Because the reporting timeline cycles are different, data in the two reports may not necessarily agree at the time of report submission. OEPM data are used for official reporting.